



Serial No. 09/574,987; Navy Case No. 82408

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:
CAROL A. BECKER
Serial No.: 09/574,987
Filed: 12 May 2000

Examiner: T. Tran
Group Art Unit: 1741

A division of parent:
Serial No.: 09/137,008
Filed: 20 August 1998
United States Patent No. 6,143,138
Issued: 7 November 2000

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TC 1700

For: VISIBLE LIGHT pH CHANGE FOR ACTIVATING POLYMERS AND OTHER pH
DEPENDENT REACTANTS

APPEAL BRIEF UNDER 37 C.F.R. 1.192

Honorable Commissioner of Patents and Trademarks
Washington, D. C. 20231

Sir:

In response to the Office Action of 30 October 2001, Appellant submits this appeal brief, appealing the

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final rejection of claims 7-13 and 27-38. Notice of Appeal was timely submitted on 29 January 2002.

REAL PARTY IN INTEREST

Under Title 15, section 3710c, an inventor who assigns his invention to the United States Government is entitled to at least 15 percent of any royalties that the Government receives upon licensing his invention. In this instance, the inventor qualifies for this entitlement as she has assigned rights to this invention to the Government.

As an inventor for the U.S. Government, the inventor also qualifies to receive incentive awards that take the form of "bonuses". These bonuses are due upon the Government inventor's case being authorized by Navy legal counsel for filing in the United States Patent and Trademark Office (PTO) and again when a Notice of Allowance is issued by the PTO. Additional financial awards may be later given based upon the value of the invention to the Navy.

The United States Government stands to gain financially from the present patent application. Besides receiving the defensive benefits of the patent, to which a largely subjective financial gain may be realized, the Government also stands to gain if the invention is licensed. As described above, the inventor is entitled to at least 15 percent of licensing royalties, and this entitlement may go up to \$150,000 dollars per inventor per invention per year. Amounts above this must be approved by the President. The remainder of licensing royalties goes back into U.S. Government coffers.

RELATED APPEALS AND INTERFERENCES

No related appeals and interferences are known to exist in the present case.

STATUS OF CLAIMS

Claims 7-13 and 27-38 have been rejected. Claims 7-13 and 27-38 are on appeal.

STATUS OF AMENDMENTS

No amendment has been filed subsequent to final examination.

SUMMARY OF THE INVENTION

Referring to the description beginning at page 6, line 15, the invention is described as a method and apparatus of rapidly changing the pH of a solution by way of a novel pH "jump molecule" that is activated by visible light. An application of the invention pertains to expanding and contracting a pH dependent polymer that has use in simulated muscle applications as well as other applications.

Claims 7-13 and 27-33 are drawn to an apparatus the basics of which are described in independent claim 7. In this apparatus, a polymer having the characteristic of changing its volume in response to a change in pH is disposed in a solution containing the pH jump molecule anthracene. Claim 7 also includes a source of visible light and contains a description as to how the visible light may be used to "irradiate said solution at a wavelength and an intensity to establish a pH change in said solution so that when said solution is irradiated with said visible light said polymer undergoes a change in volume".

In the description of her invention, the inventor describes desired characteristics of a pH jump molecule for use with several expandable and contractible pH dependent polymers. These characteristics are listed on page 11, line 7 of the description, and are as follows:

- "(1) the jump molecules should have long lifetimes at room temperature, e.g 10 milliseconds;
- (2) the jump molecule acidity constants should be grossly different in ground and triplet states, e. g., 7 orders of magnitude;
- (3) the resultant pH change should go through the midpoint (pH null point) of the utilized polymer; and
- (4) either the non-protonated or the protonated form of the jump molecule should absorb

in the visible region of the spectrum."

Through intensive and what some might describe as ingenious research, the inventor discovered that the polynuclear aromatic hydrocarbon molecule, anthracene, fits well within the above-described considerations.

The Description on page 12, line 17, states:

"Referring to FIG. 4, the protonated form of this molecule is confirmed. In FIG. 4, an absorbance versus wavelength profile shows the zero-time spectrum for protonated anthracene. The peak at 424 nm is the only peak within the visible region of the spectrum which decreases with time, and is the signature of anthracene's protonated form. It is this peak that is used to activate the anthracene polymeric actuator with visible light."

Claims 8-13 describe specific polymers that may be used with the invention of claim 7, wherein claims 10 and 13 further describe how the change in pH produced is within plus or minus 1 pH of the "pH null point" of the utilized polymer.

Claims 27-33 describe use of the invention with a specific form of the molecule anthracene: protonated anthracene.

Regarding all of these claims, the inventor goes to pains to describe in detail how predecessor researchers have provided inferior mechanisms for selectively altering the volume of an expandable and contractible polymer. Two such methods are confined to use with UV irradiation. See the Description beginning at page 2, line 20 through page 3, line 21.

The inventor stresses that "In either of the UV studies described above, the UV radiation can cause undesired ionization, photolysis and molecular ligation of a utilized polymer." (page 4, lines 1-2).

The inventor further describes how several researches have investigated the use of visible light to cause an expansion of a polymer. However in this prior art technique undesirable heat was generated,

making the reversibility of the expansion process largely uncontrollable. See the Description at page 4, lines 3-12.

The inventor discovered that anthracene can be used with expandable and contractible polymers without the adverse effects of UV degradation and without the adverse heating difficulties of earlier tried visible light techniques.

The inventor indicates in her description starting on page 6, line 15 and ending on page 7, line 3, that in using the invention with a pH dependent expandable and contractible polymer, it is desirable:

"(1) to use a source of excitation energy that is not harmful to a utilized polymer; (2) to produce an *in-situ* pH change in which hydrogen ions become rapidly present at a polymer site; (3) to sustain the resultant pH change long enough and in a volume large enough for desired ground-state reactions to occur, for example, the fully reversible expansion and contraction of a polymer; and (4) to provide a mechanism for efficient dissipation of heat produced as a result of the source of excitation energy."

As stated on page 7, line 15 of the Description,

"The invention includes a pH jump molecule that permits visible light excitation to provide a long lasting pH change to a pH dependent polymer or other pH driven reactant. The attendant pH change occurs rapidly (in nanoseconds) and will last for the excited state lifetime of the jump molecule. Further irradiation by either a continuous wave or appropriately pulsed laser can sustain the pH change indefinitely. Heat resulting from the light activation is efficiently discharged by radiative decay through room temperature phosphorescence lifetimes existing on the order of milliseconds. Thus an expandable and contractible polymer can be made to respond rapidly to a change in pH while the radiant heat-release mechanism of the invention allows the polymer to return to its initial configuration in a millisecond time frame, suitable for a variety of useful applications, including robotics."

The latter set of appealed claims, claims 34-38, are apparatus claims. The inventions of independent claims 34 and 37 both comprise a solution containing anthracene. A first of these independent claims further contains a polyelectrolyte polymer fiber in the solution. The second of these

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independent claims contain an acrylmide polymer gel in the solution.

As described above, and as supported by Appellant's disclosure, the inventor has discovered the tremendous benefits of combining anthracene with expandible and contractible pH dependent polymers. Specific combinations of these polymers are described in this last set of apparatus claims.

ISSUES

The issues presented for review are:

I. Are claims 7-13 and 27-38 unpatentable under 35 U.S.C. 102(b), as being anticipated by Zirino (US Pat. 5,334,629)?

II. Are claims 7-13 and 27-33 unpatentable under 35 U.S.C. 102(b) as "material to be worked upon"?

III. Are claims 34-38 unpatentable under 35 U.S.C. 102(b) as "material to be worked upon"?

GROUPING OF THE CLAIMS

For reasons that will become apparent in the following argument, the claims should not be considered to stand or fall together.]

ARGUMENT

Issue I is: Are claims 7-13 and 27-38 unpatentable under 35 U.S.C. 102(b), as being anticipated by Zirino (US Pat. 5,334,629)?

In the 30 October 2001 Office Action, the Examiner refers to the Office Action of 7 May 2001 to provide the reasons for the 35 U.S.C. 102(b) rejection of claims 7-13 and 27-33 on the basis of Zirino.

In the 7 May 2001 Office Action, the Examiner states that:

"Zirino teaches an apparatus, comprising: a source of visible light for irradiating a solution with a wavelength and intensity to establish pH change in the solution and to cause a polymer in the solution (to) undergo a change in volume when the solution is irradiated with light (see Fig. 2; abstract; claim 1).

In regards to claims 8-9 and 28-29, Zirino teaches the polymer being a polyelectrolyte fiber and the polyelectrolyte fiber being PAA-PVA (see claims 1 and 4).

In regards to claims 10 and 30, Zirino teaches the pH change in the solution being within plus or minus 1 pH value of a null point value of the polyelectrolyte fiber (see claim 2).

In regards to claims 11-12 and 31-32, Zirino teaches the polymer being a polymer gel and the polymer gel being an acrylamide gel (see lines 7-8; claims 35-36, 38, 40).

In regards to claim 13 and 33, Zirino teaches the pH change in the solution being within plus or minus 1 pH value of a null point value of the polymer gel. (See claim 36)."

Also as indicated in the Office Action of 30 October 2001, the Examiner states that:

"In regards to claim 34, the arguments are as presented as in claims 7-8 in the prior Office Action."

In regards to claim 35, the arguments are as presented in claim 9 in the prior Office Action of May 7, 2001.

In regards to claim 37, the arguments are as presented in claims 1 and 12 in the prior Office Action of May 7, 2001. See paragraph in claim 34.

In regards to claim 36 and 38, the arguments are as presented in claim 27 in the prior Office Action of May 7, 2001."

The Scope and Content of the Prior Art

The Patent Office cited Zirino (attachment 1) as representing the scope and content of the prior art. Zirino describes and illustrates an apparatus and method wherein an expandable and contractible polyelectrolyte fiber or gel is immersed in a pH dependent dye solution. The solution is then irradiated with visible light to cause a change in the pH of the solution and an expected change in the expansion or contraction of the polyelectrolyte substance (column 2, lines 44-63). In one embodiment, two different wavelengths of visible light are used to effectuate opposite movements of the polyelectrolyte substance (column 3, lines 14-28). Another embodiment uses a single wavelength of light with a "buffered"

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solution wherein, after irradiation, the solution returns to its former pH state (column 3, lines 38-40).

The Difference Between the Prior Art and the Claims at Issue

As stated by the Court of Appeals for the Federal Circuit in Minnesota Mining and Mfg. Co. v. Johnson & Johnson Orthopaedics, Inc., 24 USPQ2d 1321 (Fed. Cir. 1992):

"Identity of invention, for purposes of contention that patent claim is anticipated, is question of fact, and one who seeks such a finding must show that each element of claim in issue is found, either expressly or under principles of inherency, in single prior art reference, or that the claimed invention was previously known or embodied in single prior art device or practice."

More recently, the Court has stated in W. L. Gore, 220 USPQ 303 (Fed. Cir. 1993) that:

"[a]nticipation requires the disclosure in a single prior art reference of each element of the claim under consideration."

→ All of Appellant's claims contain a pH-dependent solution containing anthracene. A polymer having the characteristic of changing its volume in response to a change in pH is disposed in this solution. Some of these claims further have a source of visible light for irradiating the solution to provoke a change in the pH of the solution and thereby compel a change in the volume of the polymer (see claim 7).

→ The cited reference, Zirino, does not describe the use of anthracene. Nor is the Zirino reference sufficiently specific to embrace the use of anthracene under the principles of inherency.

Zirino's use of a pH dependent dye, and accompanying visible light irradiation, is considered to be of little difference to the work of Suzuki and Tanaka described on page 4, lines 3-12 of Appellant's specification.

→ Suzuki et al's work utilized a visible light activated chromophore coupled to a polymer gel.

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While such an approach allowed expansion and contraction of the gel, the contraction of the gel was excessively slow due to the heat produced via the visible light activation means.

Heat is considered a substantial drawback in this polymer field, as replication of synthetic muscles and the like by a polymer is thwarted by the heat-induced slow contraction of the polymer. Appellant recognized this limitation and seized upon it with the goal of discovering a pH jump molecule that would not be so susceptible to the effects of heat.

Appellant emphasizes this goal beginning on page 6, line 19 of the specification and ending on page 7, line 3, the latter of these lines indicating that it is her desire:

"to provide a mechanism for efficient dissipation of heat produced as a result of the source of excitation energy".

Elsewhere in her specification, particularly page 14, lines 19 through page 15, line 1 and page 16, lines 14-16, it is respectively pointed out that:

"Importantly, the heat created by the molecules absorbing the irradiated light is released as light of a longer wavelength. Full polymer reversibility, which is not hindered by the slow dissipation of heat, is therefore made possible for use in many polymer applications, including robotics." ;

and

"As before stated, the heat created by the jump molecules absorbing light will be efficiently discharged as light of a longer wavelength.".

The patent issued to Zirino does not recognize the deleterious effect that certain light activation mechanisms will have on expandible and contractible polymers, namely a lack of capacity for efficient heat transfer upon the solution and accompanying polymer being irradiated with visible light.

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This, among other things, is precisely what Appellant has addressed.

Zirino contains a complete lack of teaching of the use of anthracene, whether through express disclosure or through inherency. No mention is made of use of this substance. Zirino's lack of appreciation of the heat transfer characteristics of a pH light activation means evidences a lack of inherency of this substance in the teachings of Zirino.

The Examiner has concurred that Zirino does not teach an apparatus using anthracene.

The substantial differences between Appellant's claims and the teachings of Zirino compel removal of the 35 U.S.C. 102(b) rejection based upon Zirino. Removal is therefor respectfully requested.

Issue II is: Are claims 7-13 and 27-33 unpatentable under 35 U.S.C. 102(b) as "material to be worked upon".

The last Office Action, dated 30 October 2001, refers to the Office Action of 7 May 2001 to provide reasoning for the rejection of claims 7-13 and 27-33.

Under the same 35 U.S.C. 102(b) Zirino rejection described above, the Examiner further asserts that:

"Moreover, in regards to claim 7, applicant is reminded that the solution and the polymer disposed in the solution are limitations on the material to be worked upon by the apparatus, and the manner by which an apparatus is operated is a process limitation. Both the material to be worked upon and the functional limitations have been held insufficient to (be) patentably distinct over prior art when an apparatus claim is being considered for its patentability. See *In re Young*, 25 USPQ 69 (CCPA 1935); *In re Venner*, 120 USPQ 192, 194 (CCPA 1958).

In regards to claims 8-14 and 27-33, it has been known that the material to be worked upon by the apparatus has been held to have little patentable weight when an apparatus claim is being considered for its patentability. See *In re Young*, 25 USPQ 69 (CCPA 1935)."

In Appellant's earlier response to the above rejection, Appellant posed the following:

"Citing *In re Young*, the Examiner states: "that the solution, and the polymer disposed in the solution, are limitations on the material to be worked by the apparatus", and that such materials fail to add to the patentability of the claims at issue.

Applicant traverses the "apparatus" interpretation as made by the Examiner. *In re Young* refers to a concrete beam making machine wherein in claim 6 thereof the concrete beams themselves were made a part of the claim. The Patent Office rejected all of Young's claims and further rejected the cited claim upon the ground that it "includes the articles operated upon by the machines".

In the present case, Applicant asserts that the Examiner's interpretation of the "apparatus" as being other than the claim as a whole is improper. Applicant considers the apparatus, as taken from claim 7, to be:

- (1) a solution containing anthracene;
- (2) a polymer disposed in said solution, said polymer having the characteristic of changing its volume in response to a change in pH; and
- (3) a source of visible light for irradiating said solution with light of a wavelength and of an intensity to establish a pH change in said solution so that when said solution is irradiated with said visible light said polymer undergoes a change in volume."

Appellant persists in this reasoning. Appellant considers the Examiner's interpretation of *In re Young* as applied to the instant claims to be in error.

Appellant has found *In re Young* to be cited in the Manual of Patent Examining Procedure (MPEP) at section 2115 thereof. This section, titled: "Material or Article Worked Upon by the Apparatus" states that:

→ "...this line of cases is limited to claims directed to machinery which works upon an article or material in its intended use, it does not apply to product claims or kit claims (i.e., claims directed to a plurality of articles grouped together as a kit)."

Appellant's claims should be precisely interpreted as product or kit claims. Appellant poses the following analogy in an effort to describe what Appellant believes *In re Young* stands for. Under *In re*

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Young, a machine and the product it produces are the heart of the claims at issue in this case. For example, one claims a hub cap producing machine, wherein this machine comprises a press, a female hubcap die, a male hubcap die designed for insertion within said female die, wherein a sheet of metal is disposed between said dies and the press is actuated so that the male and female dies are brought into contact with opposite faces of the sheet metal and are impressed thereon. The claim does not stop there but further includes the *hub cap produced*. An interpretation of In re Young holds that the addition of the hub cap to the claim adds little patentability to the claim.

This combination of elements is vastly different from the product or kit claims of the Appellant. Appellant notes that to fall within the position of the MPEP cited section, whether this position is legally tenable or not, one must have machinery that works upon an article/ material "in its intended use".

Regarding claim 7, the Examiner appears to have chosen the "source of visible light" to be the machinery or apparatus for purposes of In re Young analysis. Though not all of Appellant's claims contain "a source of visible light", Appellant considers it to be an unreasonable stretch to consider that the intended use of a "source of visible light" is to irradiate a solution containing anthracene in which a pH dependent expandable and contractible polymer is disposed. Appellant objects to and asserts a traversal of such a position. A visible light source can be used for a multitude of purposes besides that which Appellant has stated.

Appellant asserts that the rejected claims fall precisely within the nature of the claims that the MPEP indicates are outside the scope of those considered to contain a "material to be worked upon".

The Examiner also cites In re Venner. Section 2144.04 III of the MPEP titled "Automating a Manual Activity" refers to this case. In re Venner stands for the position that a substitution of automated

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or mechanical means for what was previously manual activity will not add patentability to claims.

It is unclear to Appellant how this case applies to the instant claims. Without a more concise elaboration of this, the Appellant cannot adequately respond in defense.

Accordingly, Appellant respectfully requests that the 35 U.S.C. 102(b) rejection based on Zirino and in light of *In re Young* and *In re Venner* be withdrawn.

Issue III is: Are claims 34-38 unpatentable under 35 U.S.C. 102(b) as “material to be worked upon”?

Under the same 35 U.S.C. 102(b) Zirino rejection described above, the Examiner further asserts that: “In regards to claim 34, the arguments are as presented as in claims 7-8 in the prior Office Action.” These arguments are repeated above under Issue II.

The Examiner states further that:

“Applicant is reminded that the material to be worked upon, not the physical structure, has been held insufficient to be patentably distinct over prior art when an apparatus claim is being considered for its patentability. See *In re Young*, 25 USPQ 69 (CCPA 1935); *Ex parte Thibault*, 164 USPQ 666,667 (Bd. App. 1969); *In re Casey*, 370 F. 2d 576, 152 USPQ 235 (CCPA 1967).

In regards to claim 35, the arguments are as presented in claim 9 in the prior Office Action of May 7, 2001.

In regards to claim 37, the arguments are as presented in claims 1 and 12 in the prior Office Action of May 7, 2001. See paragraph in claim 34.

In regards to claim 36 and 38, the arguments are as presented in claim 27 in the prior Office Action of May 7, 2001.”

In the argument pertaining to Issue I above, Appellant has asserted that Zirino does not explicitly or inherently disclose an essential element of Appellant's claims, namely anthracene. All of rejected claims 34-38 contain this element, and include anthracene with an expandable and contractible polymer.

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Further, in the argument pertaining to Issue II above, Appellant has responded to the rejection of claims 7-13 and 27-34 on the basis of In re Young. In the rejection of claims 34-38, the Examiner has also cited Ex parte Thibault and In re Casey. These three cases make up the triumvirate of cases referenced in the previously cited MPEP section 2115.

To reiterate, MPEP section 2115 states:

“...this line of cases is limited to claims directed to machinery which works upon an article or material in its intended use, it does not apply to product claims or kit claims (i.e., claims directed to a plurality of articles grouped together as a kit).”

Under these present contested claims, Appellant has not been apprized by the Examiner as to specifically what the Examiner considers either the “machinery” or the “apparatus” to be. For example, claim 34 includes the elements of:

“a solution containing anthracene; and a polyelectrolyte fiber disposed in the solution”.

Claim 37 includes the elements of:

“a solution containing anthracene; and an acrylamide gel disposed in said solution”.

In applying the triumvirate of cases against these claims, it is unclear what element the Examiner considers to be the “apparatus/machine” and what element the Examiner considers is the “material” to be worked by the apparatus/machine.

Appellant considers the application of In re Young et. seq. to claims 34-38 to be little different than the application of In re Young to claims 7-13 and 27-33 discussed previously. Accordingly, Appellant incorporates her arguments pertaining to the previously discussed claims to claims 34-38.

Should Appellant’s claims 7-13 and 27-33 be considered to fall within the scope of In re Young,

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Appellant's claims 34-38 should assuredly fall outside of this scope, as claims 34-38 contain no elements that can rightfully be interpreted as "machinery" within the purview of In re Young.

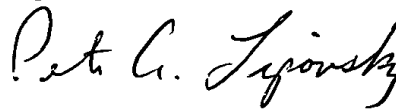
Accordingly, should such a distinguishment be made, claims 34-38 should be considered separately patentable over the remaining claims.

Appellant respectfully requests that the 35 U.S.C. 102(b) rejection of claims 34-38 based upon Zirino and further upon In re Young, Ex parte Thibault and In re Casey be withdrawn.

CLOSING REMARKS

Appellant asserts that the unique feature of her invention, that of providing anthracene in conjunction with an expandable and contractible polymer, provides a substantial improvement in the art. Such a combination is neither taught nor suggested by the cited art. Such a lack of prior art disclosure compels a finding of nonanticipation. Furthermore, Appellant's claims fall outside the scope of the In re Young, Ex parte Thibault and In re Casey perceived patentability constraints, and accordingly should be considered patentable thereover.

Respectfully Submitted,



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APPENDIX

CLAIM 7

- 1 An apparatus comprising:
- 2 a solution containing anthracene;
- 3 a polymer disposed in said solution, said polymer having the characteristic of changing its
- 4 volume in response to a change in pH; and
- 5 a source of visible light for irradiating said solution with light of a wavelength and of an intensity
- 6 to establish a pH change in said solution so that when said solution is irradiated with said visible light
- 7 said polymer undergoes a change in volume.

CLAIM 8

- 1 The apparatus of claim 7 in which said polymer is a polyelectrolyte fiber.

CLAIM 9

- 1 The apparatus of claim 8 in which said polyelectrolyte fiber is polyacrylic acid-polyvinyl alcohol (PAA-
- 2 PVA).

CLAIM 10

- 1 The apparatus of claim 9 in which said pH change in said solution is within plus or minus 1 pH value of
- 2 a null point pH value of said polyelectrolyte fiber.

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CLAIM 11

- 1 The apparatus of claim 7 in which said polymer is a polymer gel.

CLAIM 12

- 1 The apparatus of claim 11 in which said polymer gel is an acrylamide gel.

CLAIM 13

- 1 The apparatus of claim 12 in which said pH change in said solution is within plus or minus 1 pH value
2 of a null point pH value of said polymer gel.

CLAIM 27

- 1 The apparatus of claim 7 wherein said anthracene is in its protonated form.

CLAIM 28

- 1 The apparatus of claim 27 in which said polymer is a polyelectrolyte fiber.

CLAIM 29

- 1 The apparatus of claim 28 in which said polyelectrolyte fiber is polyacrylic acid-polyvinyl alcohol
2 (PAA-PVA).

CLAIM 30

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- 1 The apparatus of claim 29 in which said pH change in said solution is within plus or minus 1 pH value
2 of a null point pH value of said polyelectrolyte fiber.

CLAIM 31 (amended)

- 1 The apparatus of claim 27 in which said polymer is a polymer gel.

CLAIM 32

- 1 The apparatus of claim 31 in which said polymer gel is an acrylamide gel.

CLAIM 33

- 1 The apparatus of claim 32 in which said pH change in said solution is within plus or minus 1 pH value
2 of a null point pH value of said polymer gel.

CLAIM 34

- 1 An apparatus comprising:
2 a solution containing anthracene; and
3 a polyelectrolyte fiber disposed in said solution.

CLAIM 35

- 1 The apparatus of claim 34 in which said polyelectrolyte fiber is polyacrylic acid-polyvinyl alcohol
2 (PAA-PVA).

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CLAIM 36

- 1 The apparatus of claim 35 in which said anthracene is in its protonated form.

CLAIM 37

- 1 An apparatus comprising:
2 a solution containing anthracene; and
3 an acrylamide gel disposed in said solution.

CLAIM 38

- 1 The apparatus of claim 37 in which said anthracene is in its protonated form.